

CLAIMS

1           1.     A cold start fuel control system for use with an internal  
2 combustion engine having a plurality of combustion chambers, a source of fuel,  
3 and a primary intake manifold having an air inlet and an outlet port connected  
4 to each combustion chamber, said system comprising:  
5           a cold start fuel injector assembly having an inlet and an outlet,  
6           said cold start fuel injector assembly being fluidly connected to the  
7 source of fuel,  
8           an auxiliary intake manifold having an internal chamber,  
9           said cold start fuel injector assembly outlet being fluidly connected to  
10 said auxiliary intake manifold chamber,  
11           said auxiliary intake manifold chamber being fluidly connected through  
12 a control orifice to each of the combustion chambers at a position downstream  
13 from the inlet of the primary intake manifold.

1           2.     The invention as defined in claim 1 and comprising means to  
2 vary the cross-sectional area of said control orifice.

1           3.     The invention as defined in claim 2 and comprising a control  
2 circuit response to at least one input signal, said control circuit having an  
3 output signal and means responsive to said output signal for varying the cross-  
4 sectional area of said control orifice.

1           4.       The invention as defined in claim 3 where said at least one input  
2       signal is selected from the group of sensor output signal exhaust gas oxygen  
3       sensor output signal, an engine temperature sensor output signal, engine intake  
4       manifold vacuum sensor output signal, throttle position sensor output signal,  
5       mass airflow sensor output signal, engine rpm and fuel charge lambda sensor  
6       output signal.

1           5.       The invention as defined in claim 3 wherein said varying means  
2       comprises mechanical varying means.

1           6.       The invention as defined in claim 3 wherein said varying means  
2       comprises electromechanical varying means.

1           7.       The invention as defined in claim 1 and comprising a shroud  
2       positioned in the primary intake manifold in alignment with at least one control  
3       orifice, said shroud having a side open to its associated combustion chamber.

1           8.       The invention as defined in claim 1 and comprising a shroud  
2       positioned in the primary intake manifold in alignment with each control  
3       orifice, said shroud having a side open to its associated combustion chamber.

1           9.       The invention as defined in claim 7 and an actuator which varies  
2       the position of said shroud.

1           10.    The invention as defined in claim 9 and comprising a shroud  
2   control circuit responsive to at least one input signal, said shroud control circuit  
3   having an output signal and means responsive to said output signal for varying  
4   the position of each shroud relative to its associated control orifice.

1           11.    The invention as defined in claim 9 where said at least one input  
2   signal is selected from the group of exhaust gas oxygen sensor, engine  
3   temperature, engine intake manifold vacuum, throttle position, mass airflow  
4   sensor, engine rpm and fuel charge lambda sensor.

1           12.    The invention as defined in claim 10 wherein said shroud  
2   comprises a wall section mounted in the primary intake manifold, and wherein  
3   said varying means comprises means for varying the angle of the plane of the  
4   wall section relative to the primary intake manifold.

1           13.    The invention as defined in claim 1 wherein the cross-sectional  
2   area of each control orifice provides a substantially equal fuel charge to each  
3   combustion chamber.

1           14.    The invention as defined in claim 1 wherein each control orifice  
2   comprises a body having a through opening, said body being mounted within a  
3   seat in said auxiliary intake manifold.

1           15.    The invention defined in claim 14 wherein each body  
2           throughbore has an outwardly flared axial end.

1           16.    The invention as defined in claim 14 and comprising at least  
2           two control orifices associated with each combustion chamber.

1           17.    The invention as defined in claim 16 wherein said control  
2           orifices are arranged to induce a swirl in the fuel flow through said control  
3           orifices.

1           18.    The invention as defined in claim 1 wherein the volume of said  
2           auxiliary intake manifold chamber is less than a volume of the primary intake  
3           manifold.

1           19.    The invention as defined in claim 1 wherein said auxiliary  
2           intake manifold chamber is fluidly connected to each internal combustion  
3           chamber closely adjacent to the outlet of the primary intake manifold at each  
4           said internal combustion chamber.

1           20.    The invention as defined in claim 1 wherein the internal  
2           combustion engine includes a fuel injector associated with each combustion  
3           chamber and open to the primary intake manifold, and wherein each said  
4           control orifice is open to the primary intake manifold on a side of the primary  
5           intake manifold opposite from the associated fuel injector.

1           21.     The invention as defined in claim 1 wherein at least one control  
2     orifice has at least one vane which induces a swirl to fluid flow through the  
3     control orifice.

1           22.     For use in combination with an internal combustion engine  
2     having an engine block, a plurality of combustion chambers, intake air  
3     passages formed in the engine block so that one intake air passage is fluidly  
4     associated with and connected to each combustion chamber, a source of fuel,  
5     and a primary intake manifold having an air inlet and a plurality of outlet ports  
6     with at least one port associated with each combustion chamber, said system  
7     comprising:

8           a cold start fuel injector assembly having an inlet and an outlet,  
9           said cold start fuel injector assembly inlet being fluidly connected to the  
10     source of fuel,

11          an auxiliary intake manifold having an internal chamber, said auxiliary  
12     intake manifold having a manifold housing portion interposed between the  
13     primary intake manifold and the engine block, said manifold housing portion  
14     defining a fuel passageway fluidly connecting each air intake passage with its  
15     associated port(s) in the primary air intake manifold,

16          a plurality of control orifices, at least one control orifice being open to  
17     each fuel passageway in the manifold housing portion,

18          said cold start fuel injector assembly outlet being fluidly connected to  
19     said auxiliary intake manifold chamber,

20           said auxiliary intake manifold chamber being fluidly connected to each  
21   control orifice.

1           23.    The invention as defined in claim 22 and comprising at least  
2   two control orifices open to each fuel passageway in said manifold housing  
3   portion.

1           24.    The invention as defined in claim 22 and comprising means to  
2   vary the cross-sectional area of said control orifices.

1           25.    The invention as defined in claim 24 wherein said varying  
2   means comprises electromechanical varying means.

1           26.    The invention as defined in claim 24 and comprising a control  
2   circuit responsive to at least one input signal, said control circuit having an  
3   output signal and means responsive to said output signal for varying the cross-  
4   sectional area of said control orifice.

1           27.    The invention as defined in claim 26 where said at least one  
2   input signal is selected from the group of exhaust gas oxygen sensor, engine  
3   temperature, engine intake manifold vacuum, throttle position, mass airflow  
4   sensor, engine rpm and fuel charge lambda sensor.